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LIFE CHANGE AND ILLNESS STUDIES: PAST HISTORY AND FUTURE DIRECT--ETC(U)

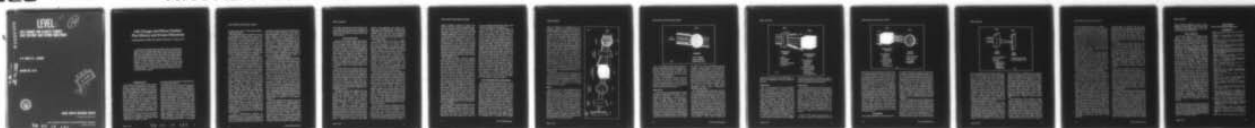
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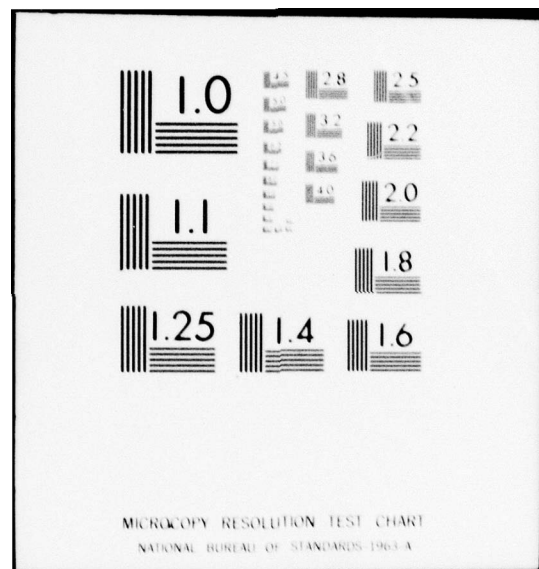
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**LIFE CHANGE AND ILLNESS STUDIES:
PAST HISTORY AND FUTURE DIRECTIONS**

R. H. RAHE & R. J. ARTHUR

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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND

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Life Change and Illness Studies: Past History and Future Directions

Captain Richard H. Rahe, MC USNR, and Ransom J. Arthur, M.D.

A selected review of life changes and illness studies is presented which illustrates both the diversity of samples that have been tested in these studies and the generally positive results which have been obtained. Although early (retrospective) work in this field led to simplistic explanations, later (prospective) studies have begun to document the several intervening variables which occur between subjects' recent life change experiences and their subsequent symptomatology and disease. A life change and illness model is presented to illustrate key intervening variables. The authors believe that future research in the field of life change and illness should concentrate on further delineations of these intervening variables — an effort necessitating active collaboration between social and medical scientists.

INTRODUCTION

One of history's most dramatic instances of major illnesses, in this case emotional ones, following in the wake of devastating life changes was in 14th century Europe during early epidemics of the bubonic plague. It is estimated that a third of the population died of "The Black Death" between 1347 and 1350, utterly demoralizing survivors.^{1,2} Shortly after 1350, a number of what we now term psychological illnesses were observed. These included a revival of the ancient brotherhood of Flagellants, whose members inflicted ritual whippings and scourgings upon one another; mass persecution of the Jews; bizarre outbreaks of prolonged dancing; child wanderings; and a resurgence of lycanthropy (which had been dormant since Grecian times), where per-

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sons ran howling through field and graveyards persuaded that they were wolves.²

In modern times, wars on an enormous scale have directly affected masses of humans. A classical example of the effects of war on the physical health of a civilian population was recorded during the bombing blitz of London in 1940-41. During the first two months of 1940, figures from 16 London hospitals showed a highly significant increase in stomach and duodenal perforations, secondary to ulcer.³ This elevated rate persisted, then returned to baseline values following the end of the blitz in May, 1941.⁴ Recent armed conflicts have highlighted the stress and illness aspects of the prisoner of war experience. Studies of prisoners of war have demonstrated that groups of men subjected to near maximal stresses show, in virtually all cases, significant and long-lasting impairment of their physical and mental health. Prisoners of war exposed to submaximal, albeit considerable, stresses showed an unequal distribution of subsequent illnesses — many became

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ill, some became very ill, while others remained in apparent good health.⁵

The relationship between catastrophic events of an extraordinary stressful character, such as The Black Death in one's village or incarceration in a concentration camp, and ill health, often of a particular kind, is well documented. But what about any connection between illness and life events of a more mundane, banal character? It is known that victims of Nazi torture developed, as a result of their malign experience, lifelong anxiety and depression.⁶ But can the events of ordinary life — the death of a spouse, being dismissed from a job, moving to a new city, say — influence one's illness susceptibility?

The notion that what happens to a person in life is intertwined with his health is an idea of great antiquity. Ancient physicians never doubted that one could die of a heart broken by unrequited love. By Victorian times, these views were expressed in concrete form by physicians such as Daniel Tuke. In his book, *The Influence of the Mind on the Body*, published in 1872, Tuke outlined many disease states, including sudden death, where dramatic life events evocative of strong emotions appeared to exert appreciable effects.⁶ Early in this century, Sigmund Freud, along with colleagues such as Alfred Adler, outlined concepts of early life stress and illness susceptibility, including the notion of illness specificity.⁷ Walter B. Cannon, and later Hans Selye, demonstrated clear-cut physiological ramifications of emotional stress in animals.^{8,9} Franz Alexander, Adolf Meyer, Stanley Cobb, Harold G. Wolff, Stewart Wolf, and George Engle deserve major credit for pursuing life stress and illness studies with human subjects; these researchers and their followers tremendously refined experimental approaches to studies of the influence of life stress on the *onset*, *course*, and *outcome* of several disease states.¹⁰⁻¹³ In the review to follow, we will consider only life change and illness *onset* studies. This is because once illness symptoms are recognized by an individual, his subsequent life changes may well be *in response* to these symptoms, and the possible etiologic significance of life change becomes unclear.

A major methodological difficulty in measurements of life stress by researchers in the middle of this century was that their assessments of stress were frequently confounded by the effects of stress. In other words, rather than focusing attention

on the nature of the life stress itself, researchers concentrated on patient's reports on and on psychological interpretations of the effects of life stress on persons' thoughts, moods and emotions. For example, Wolff and his students frequently commented on the personal, interpersonal, and even symbolic nature of the patient's life situation prior to illness onset.^{11,12} Engle and his followers focused their attention on patients' feelings of loss, helplessness and hopelessness generated by their life stress experiences.^{13,14} Green, although he specifically enumerated several life change events occurring in the lives of children during the two years prior to onset of leukemia, interpreted these changes in terms of intrafamilial psychodynamics.¹⁵

A shift in methodological emphasis from subjective testimonies of the effects of life stress to more objective analyses of the life stresses themselves was apparent in the early 1950's. In London, Kissen observed that patients receiving a diagnosis of tuberculosis at a pulmonary disease clinic had experienced significantly more recent stress events in their lives than had other patients coming to the same clinic and found to be free from major pulmonary disease.¹⁶ At the same time, Hawkins and Holmes in Seattle were taking inventories of tuberculosis patients' life change experiences which had occurred over the 10 years prior to patients' recognition of tuberculosis symptoms. These researchers noted that 50 percent of the life change events patients reported over the 10-year interval clustered into the final two-year period immediately prior to disease onset.¹⁷ In the early 1960's, Rahe and Holmes set to work standardizing life change measurement techniques and initiated scaling studies where typical life changes events were weighted according to their various degrees of significance for the average individual.¹⁸⁻²⁰

It should be emphasized that subjects' recent life change events represent only a single dimension of life stress. Life change events signify transitions in a person's psychosocial life adjustment — they do not generally indicate a person's chronic life difficulties, nor anticipated (future) life stress. Nonetheless, subjects' recent levels of life change do reflect current environmental demands to which most persons endeavor to adjust. Psychological and physiological efforts necessary for such adjustment, if severe and/or protracted in time, appear to predispose individuals towards the development of illness. We will

now present a selected review of life change and illness studies which illustrates both the diversity of patients and illnesses that have been studied by this method and the generally consistent results that have been found.

SELECTED REVIEW

Even the act of conception might be influenced by psychosocial events which impinge upon parents' lives. For example, Williams and Parkes have suggested that birthrate may be influenced by significant recent life events. In a small mining community in Wales, a stockpile of coal slid and engulfed the small community school along with several nearby houses, killing 116 children and 28 adults. In the two to three years following this disaster, the birthrate of the community increased by nearly 50 percent. This finding was in contrast to falling birthrates in neighboring communities. Additionally, these new births in the mining community were not confined to families who had lost children in the disaster.²¹

Life change events for an expectant mother may influence the course of her pregnancy and parturition. One recent study found that expectant mothers with several recent (six months prior to pregnancy) life changes had significantly more complications of pregnancy and parturition than did pregnant women without such changes.²² An earlier study, by a separate team of investigators, suggested that expectant mothers with high levels of recent life change combined with a paucity of coping capabilities had a significantly elevated pregnancy complication rate compared to controls.²³

Life changes of parents and subsequent illnesses or accidents involving their children have been studied. Irish mothers of newborns developing pyloric stenosis frequently gave a history of recent (during the last trimester of pregnancy) bereavements, family illnesses, marital problems, housing difficulties, and unemployment of the father, in contrast to two other comparison groups.²⁴ A large-scale investigation of childhood poisonings utilized 100 families with children less than five years of age in which one child was admitted to a hospital after accidentally ingesting poison, compared with 100 control families. In the families where children had experienced a poisoning, there had been significantly more recent life change events — namely more illnesses in other family

members, more pregnancies, more recent moves, higher rates of family separations, and higher rates of disability in one or both parents — than in control families.²⁵ Many years ago, Green documented several family life change events which appeared to cluster during the year to two years prior to the onset of leukemia in a child.¹⁵

Life change buildup in the lives of children themselves prior to their own development of illness has been documented. Two recent studies demonstrating a significant relationship are those of Stein and Charles dealing with children developing diabetes mellitus, and of Heisel, who studied children first manifesting rheumatoid arthritis.^{26, 27} The leading cause of death and disability in teenagers and young adults is traffic accidents. Studies of life change events occurring in the lives of youthful drivers involved in a serious traffic accident have been carried out retrospectively by Selzer and Vinokur, and prospectively by Sobel and Underhill.^{28, 29} Both teams of investigators found recent life change events at significantly higher than expected rates in the lives of (male) drivers having accidents in contrast to non-accident controls.

Several studies of young adults' life changes and (minor) illness experiences have been conducted at universities and in the military. Students with highly elevated recent (the previous year) life change levels were compared to matched controls with moderate and low recent life change levels. Students with highest life change totals reported highest numbers of subsequent illness episodes; students with moderate recent life change totals reported moderate numbers of subsequent illnesses; low life change students reported lowest follow-up illness rates.^{30, 31} These university studies largely confirmed previous large-scale studies of young men in the military.^{32, 33, 34} These military studies demonstrated that subjects' recent (past six months) life change levels could serve as significant predictors of near-future minor illness symptomatology in these prospective investigations.

The life change and illness methodology has been valuable in studies of adult men and women developing psychiatric illnesses. Brown and Birley, in London, found that structured interviews with psychiatric patients, as well as interviews with these patients' next of kin, provided reliable histories of recent life change buildup shortly (three weeks) prior to the onset of acute schizophrenia.³⁵ Myers, a

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medical sociologist, included life change events questions along with standard demographic questions in a community survey in New Haven, Connecticut. This survey also included a scale for estimating respondents' psychological symptoms. Myers and colleagues repeated this survey two years later. Persons whose life changes had increased over the interval demonstrated a worsening of their mental status, while those persons reporting a decrease in life change level over the two intervening years showed an improvement in their mental status.³⁶ Paykel and co-workers found that recent (past six months) life change events occurring in the lives of patients admitted to the hospital for depression are nearly twice the level as that seen in a healthy matched control group. Furthermore, patients who had attempted suicide indicated four times the controls' level of recent life change events.³⁷

Life change and illness researchers studying diseases of late adult life have also found significant life change buildup in the lives of men and women prior (recent six months) to their development of severe cardiovascular disease and even death. Adler and Engle documented this phenomenon in stroke patients.³⁸ Rahe and colleagues, in Scandinavia, have demonstrated a life change buildup prior (six months) to myocardial infarction which reached a level nearly 100 per cent higher than patients' "baseline" levels. Further, recent life change levels were seen to build to between 200 and 300 per cent above baseline levels during the final six months of life for patients who died suddenly from their heart disease.³⁹⁻⁴¹ DeFaire, in his studies of Swedish identical twins discordant for death due to coronary heart disease, found significantly higher recent life change levels reported for the twin who had died (over a four-year period prior to death) compared to the surviving twin's life changes level for the chronologically identical four-year period.⁴² The life changes encountered by old people upon entering a nursing home appear to account for a major portion of their unexpectedly high death rates during their first year of residence.⁴³

Studies of patients with fatal illnesses have led some investigators to consider the effects of a very significant life change, death of a spouse, for example, on the subsequent health of the survivor of the marriage. Madison and Viola, as well as Parkes, have found that widows and widowers develop significantly more illness during the six months to

one year immediately following the death of their spouse than do matched control groups.⁴⁴⁻⁴⁷

Thus, the findings of a number of different researchers who have utilized diverse recent life change and near-future illness methodologies have shown similar findings; many diseases of infants, children, teenagers, adults, and elderly persons appear to have their onset in life settings of elevated recent life change. It should be pointed out, however, that most of the studies mentioned above provide only mean life changes and illness data, applicable to the group as a whole; individual variability in life change buildup and disease onset was often not examined. In the early Seattle studies, for example, approximately 30 percent of subjects reporting very elevated life change levels did not become ill over the following year. Even amongst the prisoner of war group exposed to submaximal stress a small percentage of persons did not show subsequent illness.⁴ Why do some people "succumb" to their recent life change buildup while others apparently "escape"? What are the likely psychological and physiological pathways along which subjects' recent life changes exert their effects? A large number of medical, psychological, and sociological studies shed light on these questions. To better conceptualize these "stress tolerance" data, we formulated a life changes and illness model.⁴⁸ The next section will present this model along with supporting literature.

A LIFE CHANGES AND ILLNESS MODEL

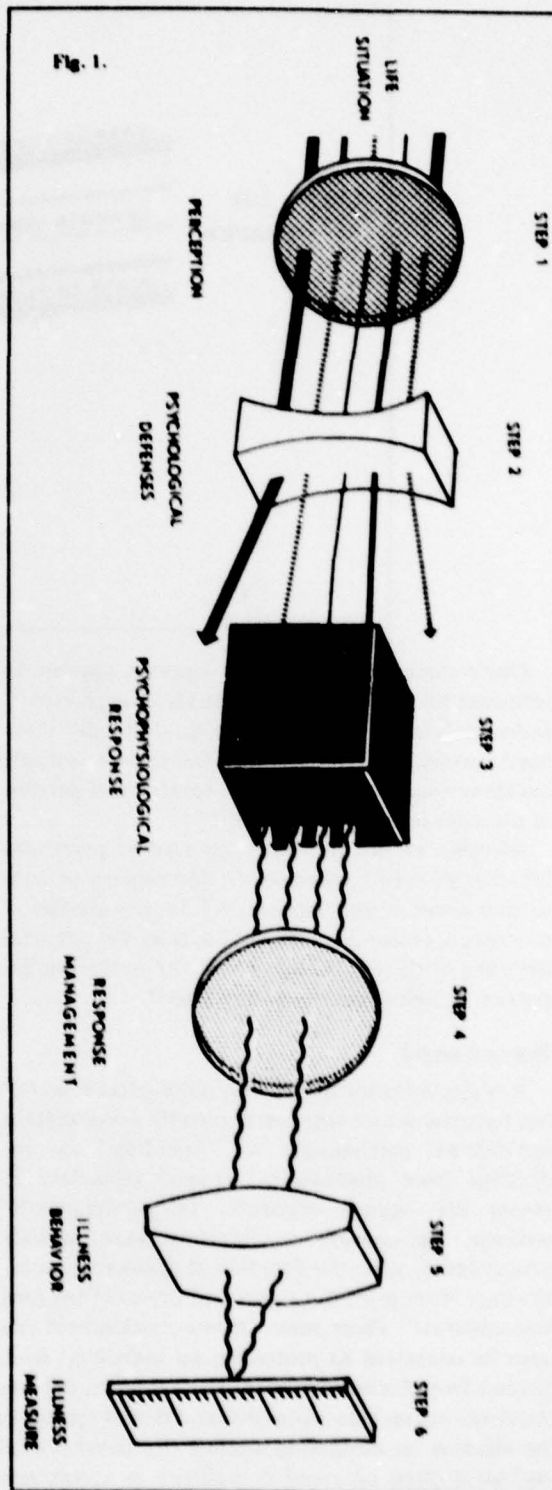
Our life stress and illness model utilizes a series of optical lenses and filters to represent important steps along a pathway extending from a subject's exposure to recent life change events to his eventual report of an illness. Looking from left to right in Fig. 1, a subject's recent life change exposure is indicated by a series of "light rays" of different intensities. Solid dark lines represent highly significant life events, thinner and dotted lines represent less significant events. The influence of perception in altering an individual's assessments of his recent life changes is represented by a "polarizing filter" shown in step 1. Possible sensitization, or desensitization, of a subject to certain life change events is indicated by a thickening or a thinning of the light rays as they pass through the filter. The role of ego defense mechanisms is represented by the negative lens in step 2. Certain defense mechanisms appear capable of "diffracting away" the impact of life change

events. Life changes not so diffracted pass on to stimulate a multitude of physiological reactions. Psychophysiology is represented by the "black box" in step 3. Wavy lines emerging from the black box now cease to represent recent life events and begin to indicate various psychophysiological responses to perceived and "undefended" life change events. Next, a "color filter" shown in step 4 indicates how subjects may cope with and "absorb" certain of these psychophysiological reactions. It is generally assumed that prolonged psychophysiological activations, if "unabsorbed," lead to organ dysfunction and eventually to bodily symptoms. Symptomatic individuals may then seek medical care, especially if they interpret their symptoms to be dangerous. A subject "focusing" his attention on his body symptoms is indicated by the "illness behavior" positive lens in step 5. If these symptoms are reported to medical personnel, the person is likely to receive a medical diagnosis and have it recorded in his health record. Health records are a favorite source of "caseness" in epidemiological studies. The possibility of a person's health record being used as a measure of illness is represented by the "illness rule" shown in step 6.

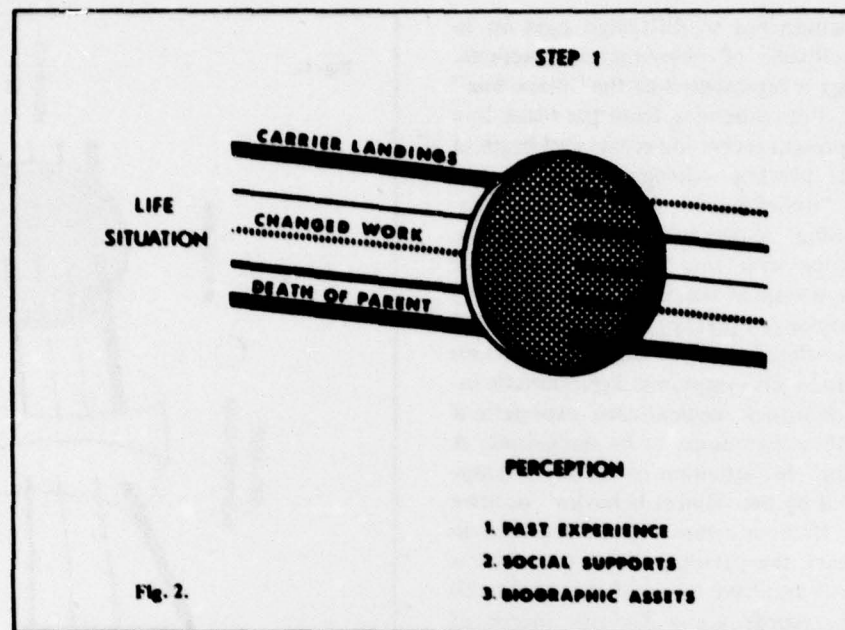
It must be realized that, as with most models, this view of life stress and illness is a simplified one. Omitted are possible translocations of the filters and lenses as well as probable feedback loops between intervening variables. Nonetheless, this simplified model incorporates a great deal of the existing literature on stress tolerance.

Step 1

Step 1 in the model is shown enlarged and with added detail in Fig. 2. Three examples of recent life change events are given — laid off work, a residential move, and death of a parent. The polarizing filter (step 1) indicates that the significances of these life change events may be altered by a subject's perceptive set. For example, many researchers have emphasized the apparent lifelong positive or negative influences of early life experiences such as deaths (or desertions) of parents, religious upbringing, financial situation, residence, and school attendance and performance.¹⁸⁻²⁰ We term these positive early life influences "biographical assets" and the negative early life influences "biographical liabilities." Both of these influences may affect how a person perceives the significances of his recent life events.



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One's current level of social supports appears to influence his perception of recent life change events. Individuals may see life events as decidedly more burdensome when they find themselves socially isolated compared to when they have several persons or places to turn to for support.⁵¹⁻⁵³

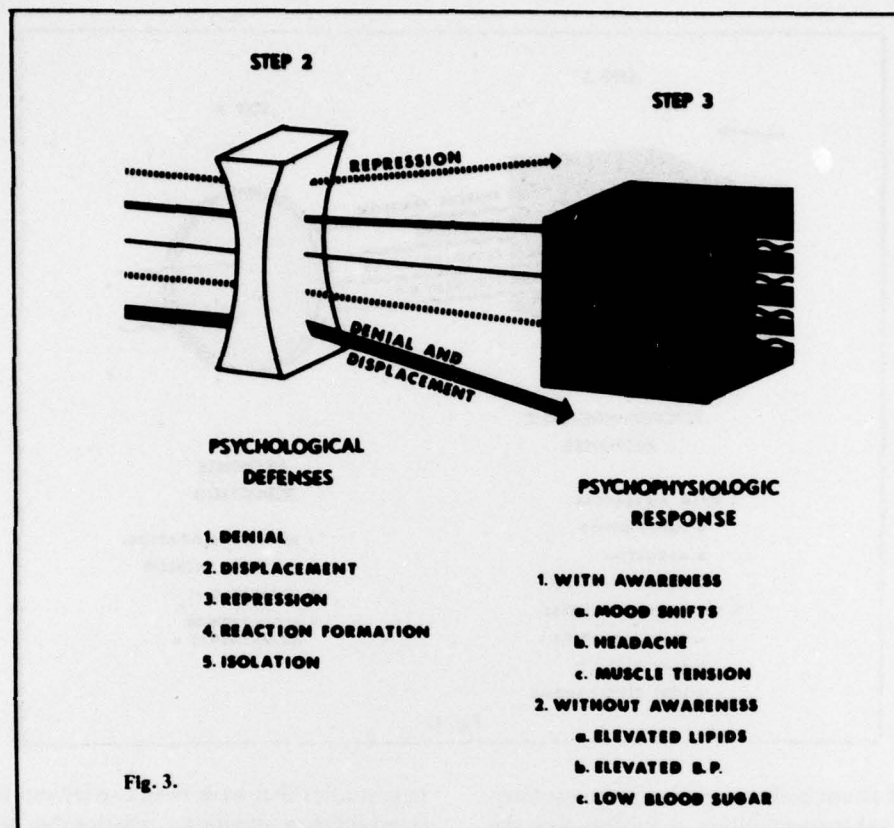
Whether or not previous exposure to particular life change events sensitizes or desensitizes persons to that event is still unclear.⁵⁴⁻⁵⁵ In any studies of this nature researchers should consider the personal meaning of the life change event, the recency of exposure, as well as previous outcomes.⁵⁶

Steps 2 and 3

A major advance in psychophysiological research has been the documentation of the efficacy of certain ego-defense mechanisms in "shielding" an individual from physiological arousal secondary to recent life change exposure. In psychoanalytic writings, ego-defense mechanisms were initially postulated to serve the function of protecting an individual from primitive urges and drives of his own unconscious.⁵⁷ These same defense mechanisms can also be conceived as protecting an individual from threats from his environment. For example, defense mechanisms such as repression and denial appear to be effective in mitigating against the physiological upheaval often observed in patients in a coronary

care unit.⁵⁸⁻⁵⁹ In a study at the National Institutes of Health, urinary excretion of 17-hydroxycorticosteroids was measured in parents whose children were dying from leukemia. Parents who apparently displaced much of their unpleasant affects and presumably utilized a high degree of rationalization and intellectualization concerning the fate of their children showed no elevations in urinary 17-hydroxycorticosteroid excretion. In contrast, those parents who were psychologically undefended from the imminent loss of their children showed significantly elevated urinary 17-hydroxycorticosteroid excretion rates.⁶⁰

The psychophysiological "black box" shown in step 3 in the model represents the entire repertoire of psychophysiological responses of the human organism. These psychophysiological responses can be roughly divided into two categories. First, there are responses that the person is aware of, such as sweating, pain, muscle tension, and so forth. Second, there are those responses which generally occur outside an individual's awareness, such as elevated serum lipids, mild to moderate elevations in blood pressure, mild to moderate degrees of hypoglycemia, and so on. As pointed out by Mason, however, these psychophysiological responses can be immediate and/or delayed, uniphasic and/or multiphasic, and even interactive.⁶¹ Thus, studies of single psy-



chophysiologic responses, though illuminating, are often an oversimplification of the full panoply of responses.

Steps 3 and 4

Fig. 4 is an enlargement of step 3 (psychophysiologic response) and step 4 (response management) of the model. If a person becomes aware of his psychophysiologic responses, and particularly if he sees these responses as threats to his health (symptoms), he may elect to employ certain "response management" techniques. One technique, muscle relaxation, may "absorb" the muscle tension leading to elevated blood pressure, for example.⁶² Techniques which deal with elevated serum lipid levels include physical exercise and medication.^{63,64} "Cognitive strategies" encompass several techniques of psychological coping such as minimalization, distraction, avoidance, and selective awareness in the reduction of symptoms.^{65,66} In our model, we restrict the use of the term *coping* to conscious response management practices designed

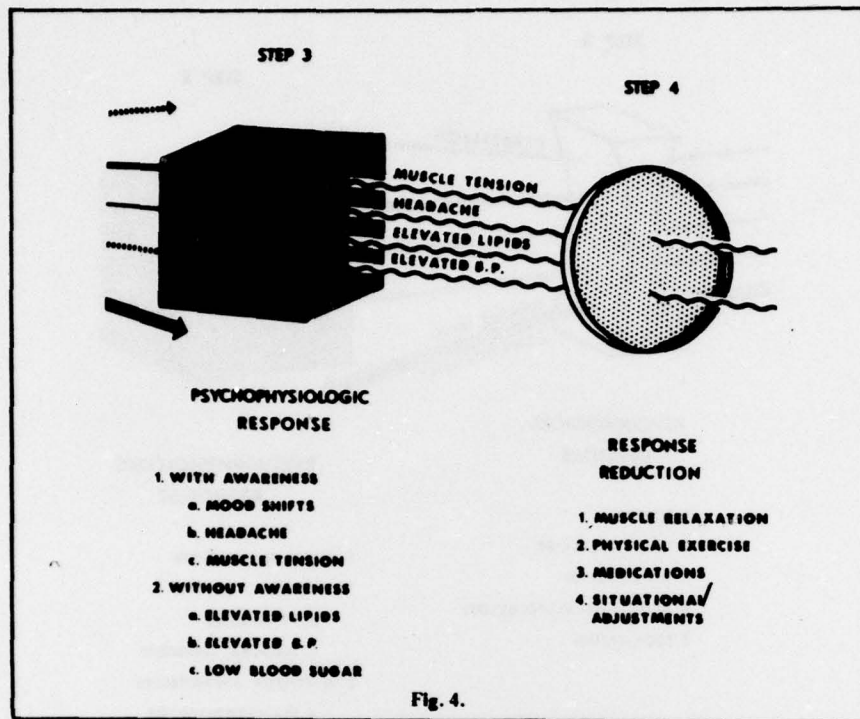
to reduce body symptoms. In contrast, we limit the definition of *defense* to *unconscious*, almost reflexive protective shielding from the environment.

Steps 5 and 6

Fig. 5 illustrates examples of the final two steps in our model. The positive lens (step 5) symbolizes an individual focusing his attention on two persistent body symptoms — headache and elevated blood pressure. Research emanating primarily from sociology has labeled this activity "illness behavior."^{67,68} If an individual then seeks medical attention, he may go on to adopt certain "sick role" behaviors such as missing work, going to bed, and becoming dependent upon medical caretakers.^{67,68,69} Step 6 is fulfilled when an individual's medical consultation leads to a diagnosis (hypertension, in Fig. 5) and this diagnosis is recorded in his health records.

In our U.S. Navy studies we measured men's recent (past six months) life changes (step 1 in the

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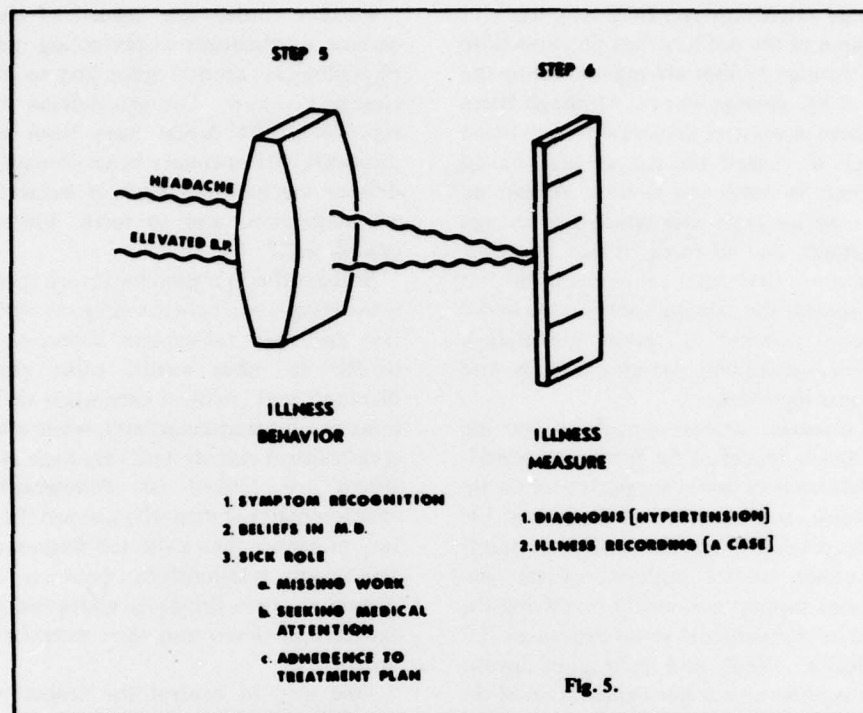
model), their current body symptom awareness (step 3), and their subsequent illness reporting over the next six months to one year (step 6). Pearson product moment correlations run between steps 1 and 3 approximated 0.30. Correlations between steps 3 and 6 were approximately 0.24. However, correlations between steps 1 and 6, the full pathway illustrated in our model, fell to 0.12.³¹ Although these correlations were all statistically significant ($p < 0.01$), the falloff seen between dimensions that were three steps apart compared to dimensions that were six steps apart was quite apparent. These data indicated that the further apart were any two steps in the model, the greater were the chances for "scatter" in their relationship. That is, although subjects' recent life changes exposures seemed moderately related to their current level of perceived body symptoms, many symptomatic persons apparently did not ultimately seek medical consultation. Thus, the relationship between subjects' recent life change levels and their subsequent illness reports proved to be relatively weak.

DISCUSSION

The numbers and diversity of life changes and ill-

ness studies that have been carried out to date firmly establish a significant relationship between subjects' recent life change experience and their subsequent development and reporting of both minor and major illnesses, and even death. The relationship of recent life change to near future illness appeared to be a powerful one in early retrospective studies. More recent work, however, utilizing prospective designs, has shown that while recent life changes remain a significant predictor of near-future illness in a variety of illnesses, the relationship is a relatively weak one. Stronger associations are seen between subjects' recent life change experience and their subsequent levels of psychological and physiological symptoms.

Recent life change events can be simply counted, they can be scaled as to their relative significances, they can be divided into socially desirable versus socially undesirable events, and they can be divided into life change events over which the individual has some control versus those over which he has little to no control. To date, very little gain has been achieved by these various manipulations of life change measurement over simply counting them. In our large-scale Navy studies, for example, we found



that the correlation between simply counting subjects' recent life changes versus using the life change unit, or LCU, scaling system for the life change events was nearly 0.90.⁷⁰ Also, when we asked our subjects to indicate whether they saw their recent life changes as positive (socially desirable), negative (socially undesirable), or neutral events, we found little unanimity of opinion in regard to these categorizations.⁷¹ There is some recent evidence that socially undesirable life change events may be more "stressful" for patients with mental disease, namely depression, than socially desirable life change events.⁷² Ongoing studies are attempting to analyze illness associations between recent life change events categorized by the amount of control subjects felt they had over these events.⁷³

At least two reasons are apparent for the meager success of attempts to refine life change event measurement. First is the matter of frequencies of life change event occurrence. By far the most common recent life change events are those which have similar low-order (LCU) scaling weights.⁷⁰ Although very significant recent life change events, such as death of spouse or being fired from work, are certainly far more meaningful to the average person

than events such as a residential move or taking a vacation, the frequencies of occurrence of death of spouse or being fired from work are so low in small samples of persons that refinements in their measurement are rarely called into use. Second is the concept of life change itself. If *change* in one's psychosocial adaptation is the important variable, then positive events cause change as well as negative events. If negative events seem to have higher associations with certain diseases, such as depression, it may simply be that this is a function of the generally greater change demanded by socially undesirable events compared to socially desirable ones.

In our laboratory we have attempted to measure subjects' perceptions of their recent life change events by having them scale these life changes, in a much more simplified manner than previously used in life change scaling studies.^{19,70} Hence, for each of our subjects, we obtain their own scaling weights. Although our subjects' subjective scores show a rank order correlation with our original LCU weights at a level of 0.85, we have obtained higher correlations between subjects' recent life changes and their subsequent illness reports using the men's subjective

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recent life change weightings over LCU weights.⁷⁴

It is the opinion of the authors that precious little will be gained through further attempts to refine the measurement of life change events. Although there are perhaps scores of masters theses yet to be written which will seek to extend the list of life change events, scale them in some new fashion, reexamine the arbitrary time intervals over which life change events are counted, and so forth, it has been our repeated experience that such refinements do not *substantially increase* the existing correlations found between subjects' *number of* recent life change events and their subsequent symptomatology and near-future illness reporting.

There are, however, several aspects of the life changes and illness model to be further explored. For one, the influence of social supports on how individuals perceive and react to their recent life change experiences seems ripe for study. Certainly work from animal studies underscores the importance of social support systems in modifying the threat involved in experimental stress exposures.^{74,75} Studies by Bruhn, Wolf, and colleagues invoke social support systems as a major explanation of the low heart disease rate in Roseto, Pennsylvania.⁷⁶

The links between subjects' recent life change experience and their physiological responses also is an exciting area for future investigation. Theorell and associates found a moderate correlation (0.32) between subjects' recent (one week) life change experience and their 24-hour urinary excretion of epinephrine.⁷⁷ Evidence from our Navy studies suggests that particular physiological responses are keyed to subjects' perceptions of their recent life change events. For example, our studies of men undergoing severe training stresses have shown that when trainees viewed their training demands as novel, somewhat frightening, but surmountable challenges, they demonstrated significant elevations in their serum uric acid levels. On the other hand, when they perceived their training as burdensome, depressing, and as demands which carried with them a high likelihood of failure, they showed a fall in their serum uric acid level and significant elevations in their serum cholesterol levels.⁷⁸⁻⁸¹ Thus, correlations run between subjects' numbers of recent life changes and one or more physiological responses may show no significant results unless specific perceptions of the recent life events are also measured.

Further studies are needed of the role of ego defense mechanisms in protecting individuals from physiological arousal secondary to their recent life change exposure. The ego defense mechanisms of repression and denial have been studied in individuals with coronary heart disease, but do other defense mechanisms, such as isolation, projection, rationalization, and so forth, protect individuals equally well?

Still another question for future researchers is why is the correlation between subjects' symptom perception and their subsequent illness reporting so low (0.24)? In other words, some symptomatic individuals seek medical care when their body symptoms reach a particular level, while others may never seek medical care despite very high symptom levels. When we looked at demographic and job characteristics of men who utilized the ship's dispensary at higher than expected frequencies, we found significant relationships between subjects' age (younger), race (blacks), education (less) and job satisfaction (low), and their number of dispensary visits.^{82,83}

One way to control for illness behavior is to schedule periodic medical history and physical examinations for all subjects in a prospective study. This procedure will secure far more accurate illness incidence data than that obtained through conventional illness reports. In their prospective studies, Cline and Chosey performed just such routine medical histories and physical examinations on their subjects. They obtained correlations of approximately 0.35 between their subjects' recent (six months) life changes and illness incidence rates over the following year.³⁴

As the life change and illness concept has become popularized, a certain imprecision of thought has become apparent. It has seemed to some as if there is as close and immediate relationship between life change and illness as is the relationship between staphylococci endotoxin and acute dysentery. This kind of conceptualization is simplistic. There are several intervening steps which exist between subjects' recent life change experience and their subsequent near-future illness symptoms and reports. It is essential to think in terms of a model which embraces the whole series of intervening variables if one is to begin to approximate the subtle and complex reality of why some individuals fall ill at specific times. We have developed a Recent Life Change

Tolerance (RLCT) questionnaire, based on our life changes and illness model, which we hope will aid investigators to obtain data pertinent to each of the six steps along the outlined pathway.

FINAL COMMENT

We have tried to make clear in this discourse that evidence, albeit gathered by different methodologies, for the influence of recent life events on the appearance of illness symptoms and disease has been documented repeatedly. Further, we've attempted to illustrate a number of intervening variables between changes in an individual's life and dysfunctions of a pathophysiological or pathoanatomical kind. Initial conceptions of the life changes and illness work were necessarily simple and straightforward, but as the evidence for the validity of the general concept has mounted, it has also become necessary to think in terms of the complexity of the social, psychological, and physiological variables involved. The brain, whatever its other higher integrative functions, is now seen as the major endocrine organ as well. It is in the brain that psychosocial events, impinging as they do upon the perceptual systems, are transduced into physiological events which activate the neuroendocrine axis and other systems, such as autonomic control mechanisms. We believe that further studies of an epidemiological character which correlate life change and illness will be redundant. Instead, the enormously difficult task awaits us of filling in the crucial steps in an all-encompassing model which takes into account not only environmental variables but the sociological, psychological, and physiological characteristics of the individual. We see a bright future for this field of investigation. It is truly a field in which the efforts of sociologists, psychologists, psychiatrists, physiologists, endocrinologists, and pathologists will be necessary to provide a complete picture of the precise interrelationships between the vicissitudes of life and sickness.

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INDEX TERMS

Life stress, recent life changes, psychological coping.

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A model is presented to illustrate key intervening variables. The authors believe that future research in the field of life change and illness should concentrate on further delineations of these variables--an effort necessitating active collaboration between social and medical scientists. K

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